TPRS

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President's Report

President's Report
Tom McDermott, N5EG

We had a great TPRS Fall Digital Symposium this year - one of the best in recent memory. It was held in Austin on December 12th, and attendance was up significantly over last year. The weather Friday looked bad - rain and a forecast of "light winter mix", but the actual weather was fine - cool, about 40, and the rain cleared Friday night. The first session was on Linux - and it was quite good. Stu Green provided us with a lot of information about Linux, free utilities (and the web addresses to find them) and configuration information. After that, Greg Jones talked about the flash card project (one version of which holds Linux for a PC). Then there was an update on the FHSS radio project, and another on TexNet. Joe Borovetz then discussed his high-speed ISP interconnection project. He's made tremendous progress since the fall symposium, and part 2 of his how-to article appears later in this issue. Mike Heskett filled us in on APRS, and he provides interesting details on the latest in APRS in this issue. Rather than repeat the details here, you can find all of the slides and audio on the TPRS web site (courtesy of Greg Jones), at http://www.tprs.org

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TPRS Quarterly Report

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Finally, Greg Jones led a rather talented team of people on summarizing how IP networks should be inter-worked with amateur networks. We discussed the current configuration of the 44-net, and the various options for connecting high-speed amateur devices to the Internet, including tunnels, proxies, and gateways. Several of those in attendance work for Internet Service Providers (ISPs) and Network Service Providers (NSPs) which helped us tremendously in understanding the key issues. One of the recommendations is that we find a way to allow the TAPR FHSS radio to permit LAN-bridged operation. Joe Borovetz has successfully used the fully-routed approach, and he provides details in his article.

Taking this advice to heart - the software for the TAPR FHSS radio has been enhanced to include 802.1D-compliant LAN bridging. This was done by implementing a 6-port Ethernet switch into the software between the various I/O ports and the onboard TCP/IP stack. The bridge learns source-port addresses dynamically without any configuration, and times them out automatically after non-use. This permits the FHSS radio to have a single IP address and a single Ethernet address, and to appear as a LAN extension for connecting up computers on either end. The bridge analyzes incoming Ethernet frames and discards them if forwarding them over the radio link is a useless operation. It also permits connecting to the radio TCP/IP stack from either end of the radio link just by IP address (which is, of course, the way it should work).

This was all coded and made operational by the first week of January. Further TCP/IP testing has been on-going, and we've found and fixed several bugs in the device drivers, and some TCP errors in the stack. To configure the FHSS radio, a web-based interface has been designed, so you can point your web-browser at the radio's IP address, and it leads you through the configuration options. Banging at the FHSS stack with a lot of computers simultaneously with pings and HTTP requests helped pin down some of the bugs, and it seems to be a lot "harder" to kill it now [well, several

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hours of merciless attempts failed to kill it] (but we'll find lots more bugs as we go!).

Bob Stricklin has gotten the transmit part of the RF chain working pretty well. We built a simple, but reasonably-accurate RF probe for 900 MHz to help in calibrating the signal levels. It appears the driver is putting out 35 milliwatts (as opposed to the 100 milliwatts it should), so debugging is ongoing. Incidentally, to make the simple RF probe, get a small length of rigid or semi-rigid hard line, and solder a 450-ohm resistor to the center conductor (you can use 470 ohms, with only 0.3 dB additional error). The other end of the resistor become the probe, and a wire soldered to the braid becomes the ground. Keep the resistor leads and the ground lead short (less than 1 inch, each). The cable has to be terminated in a 50-ohm load, such as that provided by the input of a spectrum analyzer. The probe then has 20-dB of loss, but it's pretty flat vs. frequency in the 900 MHz range.

We've had some difficulty keeping parts of TexNet running lately. The most significant failure was at the North Dallas site, where both the hard-disk drive and the V.29 modem failed. Bob Morgan came up in January and replaced the modem, thus restoring connectivity between Austin and NDALLAS. He removed the PMS hard-disk from NDALLAS. The PMS hard drive has been moved to MURPHY, where it is much easier to service when it fails (the lifetime of our hard drives is about 1.5 years continuous duty). All the node numbers have been rearranged throughout the Dallas area so that you do not need to know anything about where the PMS has moved. The 'M' command will automatically route you to Murphy instead of North Dallas. Unfortunately right now we have a radio path problem between North Dallas and Murphy. The signals are strong, but the path works only in one direction. NDALLAS seems to be having problems "hearing" but no problems "talking". We have noticed a huge number of new antennas sprouting from the NDLLAS site, and it's possible that there is now severe interference to our receiver. Because of the difficulty accessing this site, it will be quite awhile before we can trace down the problem. The usual issues of frequency, power, receiver sensitivity, antenna health, etc. do not appear to be the cause of this problem.

While in town, Bob also serviced the SDALLAS node. He put a 2-meter receiver on the APRS frequency on the node, and the new APRS-enabled TexNet EPROM into the processor. Almost immediately, APRS packets started traversing the route from Dallas to San Antonio via TexNet. Bob has been a tremendous help in servicing the nodes, driving all over Texas and Oklahoma to keep them running - it's a lot for one person to do.

-30-

WHAT'S NEW IN APRS

Mike Heskett, WB5QLD

What's new in APRS? That's a tough subject to tackle. Things are changing so quickly, by the time I tell you about the things I have heard about, there will be several new items. I will not go in a lot of detail, because I might get it wrong anyway. I used to take pride in myself for staying up to date with all the changes and testing them out to see how they worked. I did say that I used to do that didn't I? I have become resigned to the fact that it extremely hard for any one person to stay on top of it all. It looks like now that several people are required to just keep current with the products/features they are using.

In no particular order, these are some of the newer items that come to mind. You can find more information about almost all these products on the TAPR website: http://www.tapr.org. Also, additional can be found on the web pages listed below.

Kenwood has come out with a new dual band HT (THD7A) that has a built in 1200/9600 Baud TNC. It's obvious that Bob Bruninga, WB4APR (the father of APRS) had a lot to do with the design. It sends compressed packets. Like the MIC-E, it can display icons on the display. When a compatible GPS is attached, it becomes a fully functional APRS tracker in a small package. For more infor-

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mation, look on Kenwood's web page http://www.kenwood.net. You can even subscribe to an e-mail reflector that concentrates on the THD7A.

PocketAPRS Another APRS author has emerged with a version of APRS designed to run on a Palm Pilot III. This product, originally named PalmAPRS, is now known as PocketAPRS. There are maps being developed that can be downloaded in the Palm Pilot III. This system might be a good solution to those that don't have a laptop or where even a laptop was just too big to use in a mobile.

WinAPRS has a fairly new release. New functions:

- Total rewrite of all protocol parsing code
- Added support for using images for maps
- Added support for internet based Map servers (tiger and mapblast)
- Added support for internet based Intellicast Weather Maps
- Changed map window buttons to Icons
- TCP/IP options are now set in a dialog box and remembered
- IGates will now forward indvidual messages to Internet EMail if formatted correctly
- Message delivery changed from parallel to sequential
- Message numbers increased to 3 digits (easier sorting of messages)
- Fixed several minor bugs in the message window display and searching
- Added Special Stations file for IGating, Flagging and other settings of stations
- KISS mode now supported

More information at Rutgers: ftp://aprs.rutgers.edu/pub/hamradio/APRS/WinAPRS/

APRSPLUS APRS+SA v0.9.22 has a new release:

- New Profile page in Setup includes entries for Power, Height and Gain (PHG) and a number of other parameters. All parameters except PHG can be queried remotely by sending a directed message. Also included on the Profile page is a edit box for entering additional

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Texas Packet Radio Society, Inc.

TPRS was founded in 1985 and is an educational, public service, and scientific research non-profit corporation. Texas Packet Radio Society goals are:

1- design and research amateur radio packet networks
2- provide education in the area of general packet usage

To accomplish better communications in the region, TPRS has been organizing statewide working groups to cover various networking topics. The current working groups are the Mailbox/BBS Group, TCP/IP Group, and the TexNet Support Group. TPRS hopes that these working groups will help promote information exchange in their respected areas in Texas. New working groups are formed as needed to provide channels for discussion and to help provide direction for that area of digital communications. Anyone can participate in a working group; TPRS membership is not required.

TexNet

TPRS has established a digital packet network protocol, a standard hardware package for the network nodes, and software modules that implement the TexNet network.

The basic design philosophy of TexNet is an open, inexpensive, multi-resource, high speed 'backbone' with access through multi-connect capable local nodes. On the high speed side, TexNet is a 9600 baud network system. For local access, compatibility with the typical 2 meter AX.25, 1200 baud, AFSK/FM station is the operational norm. Other baud rates and modulation techniques can be supported on the primary user port or secondary port. The system is totally compatible with both versions of the AX.25 protocol specifications for user connections. With these general specifications, TexNet has been designed and tested to enable all users to take advantage of this high speed, full protocol protected packet network system.

Each node offers, in addition to TexNet access, local area digipeater service, 2 conference bridges for full protocol protected roundtable or net operation, a full mult-connect, multi-user mailbox system, a local console for installation and maintenance setups, a debugger module for long distance and local software monitoring,and an interface for a weather information server for regional weather information, if available.

The NCP-PC (TexNet for PC) creates a direct interface to the PC platform. The Z80 based PC card supports 4 channels for communications. This co-processor approach allows the AX.25 and TexNet-IP to run on the card without affecting the PC. This allows the full power of the PC to be used for network applications. The versatility of this board is only now being developed and applications are endless.

The TexNet Network

The Texas TexNet network system has been operational since October 1986. When fully operational, the network reaches from the border of Mexico to Missouri. Use of the Texas TexNet system is open to all amateur operators. TPRS has been coordinating the installation of the Texas TexNet system. Further expansion of the system depends entirely upon the amateur community.

INFORMATION

TPRS is interested in spreading our information and research efforts as widely as possible. We want other groups involved with packet efforts to get in contact with us. We will provide information for those amateur packet groups that are interested in this system for their areas. If you would like more information concerning TPRS or TexNet, please drop a letter to:

Texas Packet Radio Society, Inc.
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TPRS MEMBERSHIP

TPRS membership is widespread with most members located in Texas, but members are located in other states and in foreign countries. Membership is open to any interested person. If you are interested in becoming a member and receiving the TPRS Quaterly, please send your name, address and call with membership dues of $12 per year. A membership application is available elsewhere in this issue.

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profile strings.

- Tactical callsigns have been enhanced to support remote definition of tactical callsigns.
- Drop down boxes with predefined text values are now supported for several items.
- If you are connected to the Internet, a new ?Query? item will appear on the Send Message window. These include links to QRZ for callsign data lookup, and an Internet map, centered on the location of the callsign in entered in the TO call of the Send Message window, if there is a current Posit.
- Now supports Text-to-speech as provided by Microsoft's Agent, to enable text to speech you need to download some free files from Microsoft. This is really slick, the voices used by Microsoft are much better than what the National Weather Service has begun using in their "Console Replacement System". This system will speak callsigns as they are received, bulletins, or any string you want when certain events occur.
- A new Applications Programming Interface (API) has been added to APRS+SA to support external programs that may want to create and send messages, objects and other possibilities. One such program, called DOSAP written by Bill Vodall, WA7NWP, for example has mechanisms to generate objects to track Satellites. For information about DOSAP, see http://wetnet.wa.com/~wa7nwp/aprs/dosap.html. A new documentation web page has been created at: http://www.saskriders.com/aprssa/Index.htm

APRS825 is a routine release with some minor tweaking:

- Fixed MAPFIX39 anomalies when editing maps at high latitudes
- Fixed some remote WX station anomolies
- Alt-S-TNC now lets you specify any INIT-TNC.TNC file
- Eliminated the black line artifacts when doing REPLAYS and MAPS-OVERLAYS (This crept in about a year ago. Now fixed)
- Added MAPS-OVERLAY-ATV so you can see where ATV repeaters are (this file also includes shuttle audio repreaters)
- Moved all xxx.BAS programs to a PROGRAMS directory.

I apologize for the items that were left out, and will try to provide more updates next time.
73's Mike - WB5QLD [32 50.56N 097 11.49W]

Permanent Internet Connection utilizing Spread-Spectrum Radios.
Part 2

Joe Borovetz, WA5VMS

[*Editor's note: Joe is working on providing TexNet connectivity to Muskogee, OK. His plan is to utilize the Internet to link his TexNet node to other TexNet equipment that is also linked to the Internet. In part 1 (Aug 98) of this article, Joe discussed the considerations of finding and working with an Internet Service Provider (ISP) to implement an always-on Internet connection via radio.*]

When I left off in the August issue of the Quarterly report, I indicated that I would be discussing hardware issues in part two. Since then some routing issues have come up and I will focus more on those than on hardware.

In late September, I installed a 50-foot aluminum self-supporting tower at the ISP. I used a 2.4 GHz loop yagi that I obtained from Down East Microwave. The antenna was fed with approximately 70 feet of LMR-600 hardline. At the point where I entered the building with the feedline, I installed a microwave-rated lightning arrestor that is manufactured by PolyPhaser. After a bit of antenna alignment I had a solid 1.5 mile 2.4 GHz path to my ISP. This is the point where the fun begins; I still ask myself "Am I having fun yet?"

The radios that I used for the connection were manufactured by a company called TAL. TAL is out of business in the US (I see they are still doing business in the Philippines) and TAPR has been

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granted access to the remaining US inventory of radios and routers. The TAL radio is a two part system consisting of a router and a separate radio on either 900 MHz or 2.4 GHz. The router has several types of data connections including an AUI port and a 10 base T port. The router on the ISP end is plugged into a 3Com hub in the ISP's equipment rack, and with the RF path established I should be up and running. Unfortunately I had the RF path, but no way to the outside world.

At my home QTH, I am running Linux on a 486-80 PC that acts as a router and a firewall, it also provides IP masquerading. From this PC, RF routes have been set up to remote PC's running JNOS under Linux. These routes are set up using a SLIP connection and 900 MHz Freewave radios. The firewall and IP Masquerading are used to isolate my local network from the real world while giving machines on my network access to the Internet. There are several machines on this network running various OS's including Linux, NT Workstation 4.0, WIN 95, and WIN 98. [*IP masquerading translates an entire group of private IP addresses into a single public IP address. This allows one public IP address to serve many computers. It also means that the private IP addresses do not require any formal coordination. Private IP addresses must lie in the range 10.0.0.0 - 10.255.255.255 or in the range 192.168.0.0. - 192.168.255.255, neither range contains any allowed public IP addresses. Ed.*]

The TAL radios can be configured in different ways. One way to configure them is to set them up to require an IP address for both the Ethernet port and the router. With two IP addresses per router a total of five addresses are required for the link: two for each of the TAL radio/routers and one for the destination address at my Linux-PC at the home QTH. In addition, I needed 3 more IP addresses for the other radios on the downstream side of the Linux-PC IP-masquerading gateway. I could easily end up using eight IP addresses. The requirement for multiple IP addresses turned out to be a problem for me when dealing with the ISP. They are running short on addresses. On top of that, there are some routing issues that have not been resolved. The 486-80 machine has an IP address of 198.247.207.10. The TAL's are using addresses in the 198.247.207.80 range. Temporarily, I had to surrender the .80 addresses to the ISP until such time as the new block was up and running. [*The TAL radios can also be configured in a mode where they use only one IP address per router/radio combination. Ed.*].

While I can use some of the reserved addresses in the private network space of 192.168.X.X on some of my links, I need real world (public) addresses for AXIP and JNOS linking to work. Most providers charge between two to five dollars per month for each assigned (public) address. Since I will be getting a break on this charge, I am not in a position to force any issues with my provider.

Several weeks later, my provider received his new block of IP addresses. This released the .80 series addresses for my use. I had some problems with the Ethernet port on one of the TAL routers (the one at the ISP). I found this problem when I brought the TAL home for some testing. I managed to get that problem repaired and the equipment was returned to the ISP.

During the time period when I lost the use of the .80 addresses, I was able to borrow a book on Cisco routers. Armed with this book and a generous amount of networking documentation that is supplied with Linux, I was able to work out a plan of action. I enabled the RIP dynamic routing protocol on the TAL router at the ISP. The RIP protocol supplied the necessary routing table entries for my equipment to the Cisco 2500. [*Either a manually-added route entry can be placed in the router's CLI script, or RIP IP routing can be used. Ed.*]. I found that I had neglected to tell the TAL router at the ISP that the default gateway should be the IP address of the ISP's Cisco 2500 router. [*The default gateway address tells the TAL at the ISP where to forward packets destined for the public Internet, in this case send them to the ISP's router. Ed.*]. I used Proxy-ARP to publish the hidden TAL IP addresses and the destination address of .10 on the Ethernet port of the TAL router at the ISP. The

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hidden TAL addresses are those for the router at the ISP and the IP addresses of the Ethernet port and the router at my home QTH. If you will remember, earlier in this article, I discussed the need for two addresses per router. I made sure to include a route to the Domain Name Server (DNS) at the ISP. [*ARP - Address Resolution Protocol, allows a router to associate an IP address with an Ethernet address; Proxy-ARP allows another computer (the proxy) to make this association on behalf of the end-system. The proxy does this by relaying the end-system ARP requests and responses between it's IP ports. In essence, the proxy 'lies' about the Ethernet-to-IP association. Ed.*].

At this point I started testing using the traceroute command in order to see where things “broke”. After a bit of poking here and there, I did a traceroute to tapr.org. All of a sudden, I received a routing list showing the path all the way to tapr.org. My RF Link and Internet connection was up and running!

It would seem that the working out my link routing problems was simple and straight forward. Not so. I spent quite a bit of time with the TAL manual, the Cisco manual and the Linux networking documentation. The information on how and when to use Proxy-ARP is a bit vague. Then there were a few hours spent working with the routing tables to be sure that the routing was correct. As a test of the link, I downloaded Netscape Navigator via the radio link. The 10 megabyte file was downloaded at an average speed of 12.1 Kbytes per second (around 100 kilobits per second). According to the TAL manual, any speed of 8Kbytes/sec. or better indicates that the TAL system is performing to specifications.

In the next installment of this series, I will try to cover some of the connectivity issues such as the use of the RIP dynamic routing protocol vs. Static routing tables, the use of Proxy-ARP and some samples of my routing config files.

AX-IP node coordinated in Austin

Bob Morgan, WB5AOH

The week of September 12, 1998 saw the coordination of a new node which will interface TexNet to the internet, here in Austin, and as such will greatly enhance my ability to start the whole installation process on the actual internet. I had been wondering how (un)sucessful I might be trying to start up the first one in either Denton or San Antonio instead of locally. Now the problem is solved for me, and one of the nice things was they came to me, and I didn't have to go beat the bushes. "They" in this case was the UT radio club and the local DX cluster, who are sponsoring the node. As usual, the DXC support of TexNet continues to keep us going. Many thanks to all of them.

Anyhow, the new node will be at the Univ of Texas radio club station. They very recently got an ethernet feed from someplace downstairs on the internet, and it is on an existing PC router inside the ham shack, so AX25IPD will install on that PC, run out the serial port to the TexNet node, which in this case is an MFJ1270 contributed by George, K5TR. The site is about a mile north of the Austin TexNet node, in plain line of site view with no obstructions. I elected to use one of our old RCA700's that had a weak/blown final and no preamp. I might even have to install an antenna on it, but it shouldn't take much. I got a user account on that router/pc and it works now. They are already doing other things with it, among other things it is the mail server for the club. Jim in Lafayette has already pinged it, reports the roundtrip time might have been a tad sluggish, but that was at the time the Lewinsky/Clinton file was just being released on the net, so it might possibly represent worst case.

The node took about 2 afternoons to get running. Now I haven't got any AXIP software in it, just plain old TexNet for a 1-port node, but it is running here on the bench. I think all of the components came out of the scrappile someplace or other, we didn't run out and buy anything. I have left room to install a firecode daughterboard, and if I have time I may breadboard up a firecode decoder. I will use the code on the bench to test and debug the kiss driver

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and the AXIP stuff, and when that is done, it can be installed at UT, and we will be off and running. Well as they say, it is only software. That is next. It is likely to take a little more time, but when it is done, then the software goes to all of the internet interface nodes and then we should be able to complete our project.

The particulars on this node are: Club call is N5XU, nodename/alias is UTEXAS, and node number is 41. UT ARC had just recently changed its club callsign, trading in W5EHM on N5XU. They tell me that back when dirt and radio were both new, the callsign was 5XU (experimental instead of the usual Y-series club stations), and they managed to "recover" it.

73 de Bob WB5AOH
Austin

IP Subnetting
Tom McDermott, N5EG

The subject of sub-network addressing in IP, and especially the use of the sub-network mask is always a little bit confusing. A sub-network address is a straight-forward extension to IP addressing that allows more IP addresses to be fully used. Since there is a shortage of usable IP addresses, there is always pressure to find better ways to use IP addresses more efficiently. Sub-network addressing (or "subnetting") is one technique to prevent the loss of IP addresses. We will see that sub-net addressing allows a single network address to span multiple physical networks.

In an IP address, the 32-bit address field is broken into two parts: the host field, and the network field. The network field specifies a particular network location, and the host field specifies a particular host within that network. In the original specification of IP addresses, three types of address classes were specified: class-A, class-B, and class-C. The different types of addresses refer to how many of the 32 bits are allocated to the network part of the address, and how many bits are allocated to the host part of the address. For example, if we allocated 8 bits to the network field, and the remaining 24 bits to the host field, then the Internet could consist of (at most) 256 networks, each having up to 16,777,216 hosts (this is a class-A address). If instead we allocated 16 bits to the network field, and 16 bits to the host field, the Internet could have (at most) 65,536 networks, each having up to 65,536 hosts (a class-B address). If we allocated 24 bits to the network field, and 8 bits to the ost field, then the Internet could have 16,777,216 networks, each with up to 256 hosts (class-C address).

Real networks don't all neatly fit into the above sizes, so the original Internet addressing specification partitioned the 32-bit address space into smaller ranges, containing a subset of class-A, class-B, and class-C addresses. This allowed large institutions (like the government) to have some class-A addresses, large corporations to have class-B addresses, and smaller organizations to have class-C addresses. Two other types of addresses, class-D (multicast) and class-E (reserved for future use) were also specified. The address space was divided-up, and portions reserved for the different address classes.

Address Class	Reserved Range (1st byte of IP address)
A	001 - 127
B	128 - 191
C	192 - 224
D	225 - 240
E	241 - 255

Note that a host field cannot contain all zero's, or all one's. All zero's refers to "this" network, and all-one's is a broadcast to "this" network. The figure shows how the original addressing worked, pictorially.

Continued next time...

TPRS Node Assigments
Official Publication: June, 1995
Subject to Corrections/Additions/Deletions.

X = ACTIVE/COMPLETED
T = ACTIVE/TEST
P = PENDING

Nr	Status	City/Town	Alias	Call	User Port	Remarks
1	X	Dallas	TEXNET	WR5C	145.05	PMS
2	T	Richardson	TESTBED	W9DDD	None	R&D
3	T	Richardson	RICH	W9DDD	None	R&D
4	X	Murphy	MURPHY	N5EG	145.09	
5	X	Ft. Worth	NWS	N5HCO	None	Weather PMS
6						
7	P	Beorne	BEORNE	N5VUO	145.01	(Bridged w/BNE THENET)
8	X	Geronimo	GERONMO	WB5NSN	145.07	PMS (AKA GERLNK)
9	X	Austin	AUSTIN	WA5LHS	145.07	
10	T	Austin	NQ9Q	Bryan Stroud Test Node		
11	X	San Antonio	ALAMO	N0CCW	145.09/223.44	
12	X	San Antonio	SALAMO	WA2MCT	Interface to SNS/NO USER PORT	
13	X	Denton	DENTON	W5NGU	145.03	
14	X	Lubbock	LUBBOCK	W5ERO	145.05	
15	X	Midland	MIDLAND	WB5RXA	145.05	
16	X	Greenville	GREENVL	WB5IZL	145.07	
17	X	Midland	MAFDXC	WF5E	223.58	DXCluster port 2
18	T	Austin	NQ9Q	Bryan Stroud Test Node		
19	X	Rockport	ROCPRT	N5JKH	144.99/PORT 2 446.1	
20	X	C. Christi	CORPUS	N5XCH	145.05	INTERFACE TO SNS
21	X	Pettus	PETTUS	KA5BWL	147.56	
22	T	Corpus	ESTES	KB5GD	None	Test Node
23	X	Lubbock	LBBDXC	KA5EJX	DXCLUSTER	
24	X	Austin	AUSDXC	WB5VZL	144.99	
25	P	Corpus Ch	CCSU	N5AHD	TEXT Node	
26	X	Victoria	VCTRIA	W5DSC	145.01	
27	X	Alice	ALICE	K5DYY	145.07	
28	X	Amarillo	AMARILO	WD5ILA	145.05	
29	X	Abilene	ABILENE	WB5EKW	145.05	
30						
31	P	Houston	HOUSTON	WD5HJP	UNKN	Due ???
32	P	Pearland	PEARL	UNKN	UNKN	Due ???
33	P	Rosenburg	ROSBRG	UNKN	UNKN	Due ???
34	X	San Antonio	SANTEX	WB5FNZ	223.58	
40	P	Hempstead	HMPSTD			Due ???
41						
42	X	Kingsville	TAMUK	W5ZD	144.91	(aka KINGVL)
43	P	Bryan/CollStn	SBRAZOS	KF5LN	145.05/446.10	Port 0 (PENDING RE-INSTALLATION)
44	P	Bryan/CollStn	NBRAZOS	KG5ZD	446.1	(See Nr 43)
45	X	Fannin County	FANNIN	WB5RDD	145.05	
46	X	Sherman	SHERMAN	WB5CVR	144.93	
47	X	South Dallas	SDALLAS	KF5RN	None	
48	X	Waco	WACO	WD5KAL	145.09	
49	X	Falfurrias	FALFUR	WB5FRO	None	

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50   X     Mercedes         VALLEY   NA5C    144.60  DXCluster port 2
51   X     San Isidro       ISIDRO   K5RAV   None
52   P     Brownsville      BROWX    K5RAV-? NWS node 25.54.57N 97.25.08W
73   X     Fort Worth       FTWORTH  N5AUX   144.99
80   T     AOHTST           AUSTIN   WB5AOH  NONE   R&D AUSTIN
98   X     Murphy           CARDNAL  WA6ROC  None   R&D/PMS/NMS/NETCON

               (100-150) Reserved for TexLink Node Usage

105  X     Floresville      FLORES   WD5DOE   None
106
107  X     King Mountain    KINGLNK  WB5YHC  145.05
108  X     Alpine           ALPINE   WA5ROE  145.05
109  X     Refugio          REFUGIO  WB5OLT  None
110  X     San Angelo       ANGELO   WA5JSN  145.05
111
112  P     PLAINVIEW        PLVLNK   KC5ALN  145.05
113
114        Reserved - WB5DDP
115        Reserved - WB5DDP
116
118        Moody            MOODY    W5ZDN    None
119
120
121
122
           (151-249) Reserved for Non-Texas Node Usage

160   X    Ft Gibson OK     FTGIBSN N5GIT   145.01
161   X    Muskogee  OK     MKOTST  WA5VMS  446.5   PMS
162   X    Muskogee  OK     MUSKOGE W5EJK   145.09
163
164   X    Lincoln AR       FAYETVL K5VR    145.69
165   X    Clayton OK       CLAYTON W5CUQ   145.03
166   X    Ft Smith AR      FTSMITH W5ANR   144.91
167
169   X    Tulsa OK         TULWX   N5WX    NWS WX Server
172   X    Okemah OK        OKEMAH  WB5HLR  145.69
173   X    Choctaw OK       CHOCTAW AB5H    145.69
174
175   X    Garfield AR      GARFLD  WB2ROC  None
176   X    Aurora Missouri  OARSMO  K0SQS   145.05
177   X    Mt Magazine AR   MAGAZIN KF5XB   144.95
178   X    Russelville      RSLVL   WB5BHS  UNKN
179   X    Little Rock AR   LROCK   WB5SQK  144.97  PORT 2 446.50(FUTURE)
209   T    Little Rock AR   LRTST   KA5SQK  TEST Node

                 (250-255) Network Reserve

If you are a TexNet node opearator/owner and have a correction to
make to the list, advise to
N0CCW@K3WGF.#STX.TX.USA.NOAM, or leave a message for
N0CCW on the NDALLAS PMS of TexNet.
```

TPRS Membership Application

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Membership is $12 per year. How many years are you paying for? ____

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APRS, AX-IP,

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Be sure to visit the TPRS web page:
http://www.tprs.org
for the latest information on TPRS activities.

A current listing of Packet nodes, frequencies, and networks is located in the **North American Digital Systems Directory (NADSD) on-line at:**
http://www.tapr.org/directory/index.html

Texas Packet Radio Society
P.O. Box 50238
Denton, Texas 76206-0238

ADDRESS CORRECTION REQUESTED

To: